

Remarks/Arguments:

Applicants thank Examiner Clark for her careful examination of this application and clear explanation of the claim rejections, and for allowing claims 15-20 and conditionally allowing claim 6. Responsive to the Office action, applicants cancel claims 9-14.

Regarding the rejections against claims 1-8, applicants respectfully submit that because the Ohno reference fails to disclose all the elements in the rejected claim and the missing limitation fails to support prima facie obviousness, the rejections are improper. Details follow:

1. Claim 1 describes a method of packaging ball grid arrays. The method includes the steps of
 - a. providing a substrate having a plurality of holes formed therein, each hole associated with a respective one of a plurality of contact pads formed on a first surface of the substrate
 - b. disposing a plurality of balls within respective ones of the plurality of holes such that at least a portion of each ball projects outwardly from the first surface; and
 - c. applying a force to each of the balls outwardly from the first surface to couple the balls to the substrate.

The Ohno reference discloses a method of connecting a tape-automated-bonding (TAB) tape to a semiconductor chip. It also discloses a bump sheet and a bumped tape to be used in a method of connecting a TAB tape to a semiconductor chip. The example cited in the Office action as evidence of anticipating claim 1 is copied as follows:

Balls having a mean diameter of 90 μm (87 to 93 μm in measured values) were produced using gold of 99.99% purity as a raw material. 80 μm holes were bored *in a polyimide film* of 40 μm thickness by a laser at positions corresponding to the positions of the electrodes of a 200-pin semiconductor chip. The gold balls were fixed into the holes. The fixing method will now be explained by using FIGS. 9 and 10A to 10F.

First, as shown in FIG. 9, there was prepared a substrate including *a pile of a polyimide film 40* formed with holes at positions where the gold balls are to be arranged and *a thin stainless steel plate 22* which is placed on the rear side of the film 40 and provided with holes formed at the same positions as those formed in the film 40. FIG. 10A shows a cross section taken along line XA--XA of FIG. 9. As shown in FIG. 10B, the rear side of the tin stainless steel plate 22 was evacuated so that the gold balls 6 are attracted to the hole positions of the polyimide film 40. Next, as shown in FIG. 10C, the gold balls were mechanically pushed from the front side of the film 40 into the holes of the plate 22 by means of a press 53 so that the head portions of the balls were protruded by about 5 μm from the opposite surface of the tape. In this manner, *a bump sheet* as shown in FIG. 10D was obtained in which the gold bump was fixed or positioned asymmetrically with respect to the tape surface.¹

The BGA substrate is well known in the art. The Ohno reference does not include a BGA substrate. Please note that in the passage above, the bump sheet is made of a polyimide film or a file of a polyimide film. It does not in anyway refer to an element that can be construed as or equivalent to a BGA substrate. And there is no suggestion in the reference to combine the disclosed TAB package with a BGA package. Therefore the Ohno reference does not anticipate claim 1 and it does not render claim 1 obvious. Applicants respectfully submit that claim 1 stands patentable over the Ohno reference.

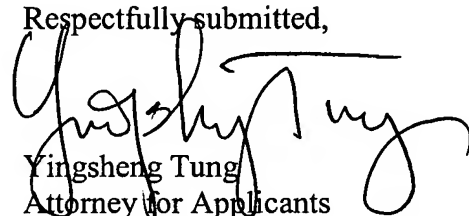
2. Claims 2-8 depend directly or indirectly on patentable claim 1 with additional limitations. In particular, claims 2 and 3 further limit the dimension and the structure of the substrate; claim 4 further limits the amount with which the balls project from the surface of the contact pads; claim 5 further limits the tool for applying the force; claim 6 further comprises heating the tool; claim 7 further limits the manner of applying the force; and claim 8 further limits the extent of force applied and the coupling of the balls and the substrate. Claims 2-8 stand patentable over the reference by virtue of their dependency and by the additional limitations they add to the base claim.

¹ US 5,164,336, col. 11, ll. 22-49.

Appl. No. 10/659,181
Amdt. dated Dec. 14, 2004
Reply to Office action of Sept. 22, 2004

In summary, applicants respectfully submit that the application is in allowable form; pending claims 1-8 distinguish over the reference because it fails to disclose all the limitations of the claims. Applicants respectfully request further examination of the application and timely allowance of the pending claims.

Respectfully submitted,



Yingsheng Tung
Attorney for Applicants
Reg. No. 52,305

Texas Instruments Incorporated
P. O. Box 655474 MS 3999
Dallas, TX 75265
(972)917-5355